# SYNTHESIS AND CHARACTERIZATION OF MN DOPED CDS NANOPARTICLES USING CHEMICAL CO-PRECIPITATION METHOD

**M.R. Verma[1], M. D. Shinde[2], S. S. Jagtap[1], G. R. Pansare[1], K. D. Diwate[1*]**

**Corresponding Author: K. D. Diwate, kirandiwate441@gmail.com**

**[1]Department of Physics, Haribhai V. Desai College, Pune- , India**

**[2]Centre for Materials for Electronics Technology (C-MET), Panchwati, Off Pashan Road, Pune – 411008, India**

***Abstract :*** Mn doped CdS nanoparticles is an interesting luminescent material. In the present work, nanoparticles of Mn doped CdS were synthesized in aqueous solution by simple co-precipitation method where molar percentage in the range of Mn 0.5%, 1%.2% was varied. X-ray diffraction study shows formation of mixed phase of cubic and hexagonal CdS. The significant peak broadening reveals formation of nanoparticles. The optical property of CdS nanoparticle was investigated by the UV-Vis spectroscopy. The band gap was found to be in the range of 1.85 to 2.01 eV. These nanoparticles can be used for photosensor fabrication.

***Keywords: Mn doped CdS, nanoparticles, co-precipitation, X-ray diffraction.***

## I. INTRODUCTION

Doping of semiconductor nanoparticles with suitable metals is an attractive area of research due to their excellent optical properties as well as their applications in devices such as solar cells, photoconductors, etc [1, 2]. Among various materials, CdS is the most important semiconductor active in the visible spectrum of solar radiation and can be used for photosensing applications[3]. Copper, manganese are the main dopants in the research on CdS based photosensors [4]. Mn doped CdS nanoparticles as visible light active optical have received interest due to their interesting luminescence properties [5]. In the present work, nanoparticles of Mn doped CdS were synthesized in aqueous solution by co-precipitation method. Different molar percentage of Mn (i.e. 0.5%, 1%.2%) is doped in CdS nanoparticles during synthesis.

## II. RESEARCH METHODOLOGY

### 2.1 Experimental Work

Mn doped CdS nanoparticles were prepared by chemical co-precipitation method

**Materials** Distilled water was used as solvent while the source of Cd, S and Mn were CdCl2.H2O, thiourea (CH4N2S) and MnCl2.4H2O respectively.

**Experimental Procedure:** CdCl2.H2O (0.1M) was dissolved in the distilled water by magnetic stirrer till the solution become clear. Then MnCl2.4H2O of predetermined molar weight for 0.5 %, 1% and 2% Mn doping was added in the solution. Afterwards, thiourea (0.1M) was dissolved in the same solution. Finally, 1M NaOH solution in 20ml distilled water prepared separately was added in previous solution dropwise until pH is greater than 11 and stirred continuously for 1h. The solution was centrifuged for half hour at 3000 rpm and washed several times with distilled water to remove the impurities and unreacted species. Finally, the powder was dried in a oven at 100 0C for 2-3hours and yellowish orange powder was obtained. The colour of the powder varied depending on Mn doping molar concentration.

**Characterization**

Structural properties of as synthesized powder samples were studied by X-ray diffraction technique. The samples were optically characterized by UV-Vis spectroscopy in the range of 200-900 nm after dispersing them in ethanol.

## III. RESULTS AND DISCUSSIONS

Figure 3.1 shows the X-ray diffraction results of as synthesized Mn doped CdS nanoparticles. XRD measurements showed that the nanoparticles have the mixture cubic and hexagonal phases of Mn doped CdS matching with JCPDS card numbers JCPDS data card # 21-629 and JCPDS data card # 41-1049. respectively. The band gap of Mn:CdS nanoparticles has been determined from the UV-Visible spectroscopy graphs (Figure ab). The band gap of Mn doped CdS nanoparticle after calculation was found to be 1.85 eV, 1.91 eV and 2.01 eV for 0.5%, 1% and 2% Mn doped CdS nanoparticles samples respectively.

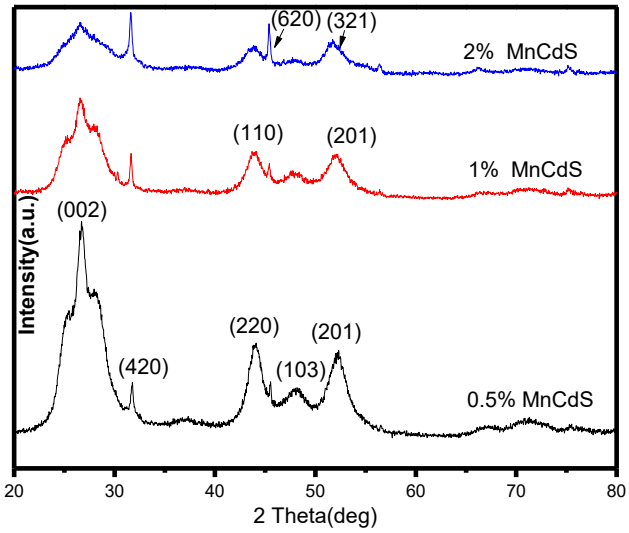


**Figure 3.1-** X-ray diffractograms of Mn doped CdS nanoparticles

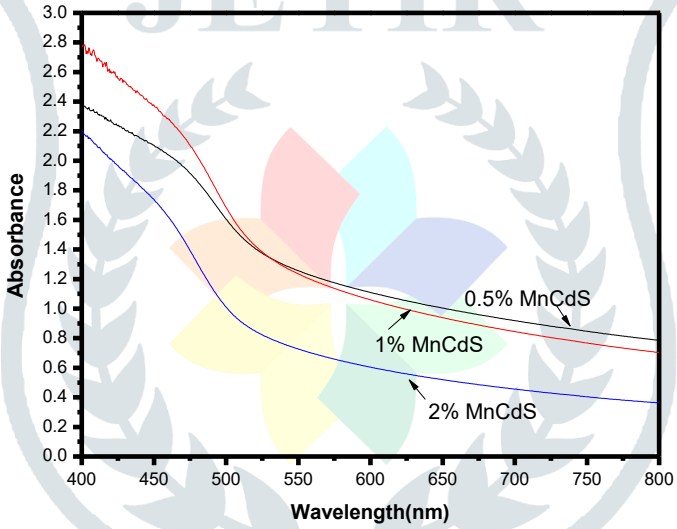


**Figure 3.2-** UV-visible spectra of Mn doped CdS nanoparticles

## IV. CONCLUSIONS

Mn doped CdS nanoparticles have been prepared using coprecipitation technique. It can be concluded that as doping of Mn increases the band gap of nanoparticle increases.

## V. ACKNOWLEDGMENT

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